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ABSTRACT

The relationship between academic performance and cognitive tempo as measured by the Matching Familiar Figures Test (MFF) was investigated in 66 learning disabled children (ages 7 to 12 years). Results of a simple correlation analysis indicated the test to be a sensitive predictor of achievement; however, this relationship was substantially reduced when results were analyzed controlling for the effect of IQ. These results were interpreted as evidence for the necessity of controlling for IQ level in research using the MFF test to investigate learning disabled children. (Author/PHR)

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Abstract

The relationship between academic performance and cognitive tempo as measured by the Matching Familiar Figures Test (MFF) was investigated in sixty-six learning disabled children. The Salkind-Wright (1977) formulation of this instrument was used. Results of a simple correlational analyses indicated the Salkind-Wright I-score to be a sensitive predictor of achievement. However this relationship was substantially reduced when results were analyzed controlling for the effect of IQ. These results were interpreted as evidence for the necessity of controlling for IQ level in research using the Matching Familiar Figures test to investigate learning disabled children. The Salkind-Wright formulation is commented on as a useful method for analysis of MFF data.

The Matching Familiar Figures Test (MFF) is a widely used instrument designed to measure cognitive tempo (Kagan, Rosman, Day, Albert, Phillips, 1964). The traditional method of using the MFF has been to create a dichotomy of impulsive (those individuals scoring below the median on response time and above the median on errors) versus reflective (those individuals scoring above the median on response time and below the median on errors) subjects. This method has been subjected to criticism on the grounds that it is potentially wasteful of the subjects who fall in the "off" quadrants (i.e., slow/inaccurate and fast/accurate) and that its basically nominal categorization loses the more sensitive power that continuous measurement affords (Ault, Mitchell, & Hartman, 1967; Block, Block, & Harrington, 1974). As a response to this methodological problem, Salkind and Wright (1977) developed an alternative model of reflection-impulsivity consisting of orthogonal style and efficiency dimensions. The style or impulsivity dimension (I) represents the continuum ranging from fast/inaccurate to slow/accurate, and is the presumed continuum underlying the traditional assignation of impulsive vs. reflective subjects. The efficiency (E) dimension ranges from slow/inaccurate to fast/accurate. The method for deriving these scores is to determine the distributions of errors and latency, and generate Z scores for each individual on errors and latency. The summation of these two Z

scores represents an individual's E score, and the subtraction of the latency Z score from the error Z score represents an individual's I score.

Recent research using this formulation has in general found the impulsivity score to be a more salient dimension than the efficiency dimension. Rollins and Genser (1977) found that the impulsivity dimension predicted performance on a concept attainment task while the efficiency dimension did not. Cullinan, Epstein, Lloyd, & Noel (Note 1) found that the impulsivity dimension discriminated LD and normal children while the efficiency dimension did not. Further evidence indicates that the impulsivity dimension is a more capable predictor of reading achievement with normal second graders than is the efficiency dimension (Loper & Hallahan, Note 2).

The next logical step in this chain of research would appear to be an investigation of the relationship between the two continua and academic achievement in learning disabled children. There is considerable evidence that impulsivity, as measured traditionally, is disproportionally represented among children with learning problems (Finch, Pezzuti, Montgomery, & Kemp, 1974; Hallahan, Kauffman, & Ball, 1973; Keogh & Donlon, 1972; Messer, 1970). Furthermore, impulsive children are less capable than reflective children on variety of cognitive measures (Kagan, 1966; Kagan, Pearson & Welch, 1966; Massari & Shack, 1973; Siegel, Kirasic & Kilburg, 1973).

In addition to the methodological problem created by the non-continuous nature of the traditional method of measuring impulsivity and reflectivity, a second often quoted methodological difficulty with the MFF is the potential confound of IQ scores. MFF scores tend to have a moderate relationship with intelligence (Messer, 1976). Since IQ is also related to achievement, it is quite feasible that a spuriously high correlation between the MFF and achievement could be found due to the effects of IQ (Block, et al., 1974).

The purpose of the present examination was to evaluate the relationship of cognitive tempo, as measured by the Salkind-Wright formulation, with achievement and cognitive ability in learning disabled children, while statistically controlling for the effect of IQ.

Method

Subjects - Subjects included 66 children (55 boys, 10 girls) identified as learning disabled, attending public school in Central Virginia. All children had been selected for a project designed to study attention in learning disabled children. Inclusion in the project required, in addition to state requirements for LD designation, that, the child be viewed by the teacher as exhibiting marked attentional problems. Ages ranged from 7.16 to 11.92 with a mean age of 9.10 years (SD = 1.24). IQ ranged from 74 to 133 with a mean IQ of 98 (SD = 13).

Instruments - Cognitive tempo was measured by the MFF (Kagan, et al., 1964). This task consists of 12 match-to-standard items. The child is instructed to point to the picture that is identical to a standard from one of six variants. If a child is incorrect in his selection, he is so informed, and instructed to try again. The two major variables scored are response time to first choice of an item (latency) and the total number of errors across items. All data were collected within a one month period in the fall of the academic year.

IQ was measured by the Wechscler Intelligence Scale for Children (WISC-R, 1974). All IQ data were collected within 18 months of the time of MFF testing.

Reading and Arithmetic achievement were measured by the Woodcock Johnson Test of Achievement (1977). This test yields grade level scores, which can be converted into standard scores. Data were collected within two weeks of collection of MFF data.

The Woodcock Johnson Test of Cognitive Ability (1977) was also included in the analysis. This test, consisting of 12 subtests, yields an IQ-like score that can be expressed either in Mental Age Units or Standard Units. Although it bears resemblance to the WISC-R in its final score, and is highly correlated with the WISC-R, its subtests are substantially different in format and appear to offer more tests requiring strategic processing.

Procedure - Because of the wide age range of the subjects included, subjects were divided into two age groups for the purpose of generation of Z scores. Once these standard scores were obtained, the subjects were pooled into one group. This was permissable since all scores being used in the correlational analysis were standardized.

Results

The means and standard deviations for MFF, achievement, cognitive ability, and IQ data are summarized in Table 1.

The correlations between Impulsivity with Reading and Arithmetic were not substantially different in the two age groups. The correlation of Impulsivity with Cognitive Ability was somewhat higher for the younger subjects ($r = .35$, $p < .01$) than for the older subjects ($r = -.25$, $p < .05$). It should be pointed out that all data here reported employed some type of standard measurement which was relative to a subjects' age level. Developmental differences between age groups were not, therefore, expected.

The simple correlational analysis indicated in general a stronger relationship between Impulsivity and dependent measures (Table 2). These correlations, however, were substantially diminished when statistical analysis controlled for the effect of IQ.

The correlation between IQ and Impulsivity was -.27 ($p < .05$) while that between IQ and Efficiency was not statistically significant. The correlation between latency

and errors, -.39, was significant at the .001 level. This correlation was expected and is well in line with existing literature.

Discussion

Data from the simple correlational analysis suggest that impulsivity is a more sensitive predictor of achievement among learning disabled children. The tendency on the MFF to respond quickly would appear to be associated with lower achievement, regardless of the accuracy involved. For the learning disabled child, the cost, in terms of achievement, of impulsivity would appear to be greater than the cost of inefficiency.

This conclusion is, however, strongly undermined by results of the partial correlational analyses. Controlling for IQ level had the effect of substantially reducing the significant effects. The impressive impact of IQ level on MFF performance has been cited in the literature (Block, et al., 1974; Denny, 1974; Messer, 1976). This argument contends that the same general intellectual ability factor that determines achievement level would also effect performance on the MFF.

Because of the relative recency of the Salkind and Wright (1977) formulation, few studies have been reported relating I to E to achievement. Of those reported, only one, to this author's knowledge, contained a control for the effect of IQ.

Loper and Hallahan (Note 2) did find a relationship between Impulsivity and Reading Achievement in second graders, while controlling for IQ. It is plausible that in a population defined by academic underachievement, the effect of general intellectual level is more critical than is conceptual tempo. The present results underline the necessity of controlling for IQ level in experiments using the MFF, particularly when learning disabled children are included as subjects.

The Salkind-Wright (1977) formulation appears to be a very useful method for analyzing MFF data. A correlational analysis such as is presented here would not be possible using the method of dichotomization of MFF data generally seen in the literature. In addition, the ability of the Salkind-Wright technique to use the data of all subjects, (the fast/accurate and slow/accurate as well as the slow/inaccurate and fast/inaccurate) is particularly useful with LD children. This population evidences considerable variability within its ranks. The Salkind-Wright formulations' ability to handle the full range of this variability for MFF data is an impressive advantage.

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Table 1

Means and Standard Deviations of Collected Data

	All Ss		Young Ss		Old Ss	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
MFF Latency	12.2	6.8	11.21	6.0	13.27	7.5
MFF Errors	12.8	6.5	14.0	7.2	11.4	5.3
Reading Achievement	76.7	18.8	75.9	19.3	77.5	18.4
Arithmetic Achievement	80.2	20.7	81.1	21.1	79.1	20.5
Cognitive Ability	85.7	14.0	86.4	15.6	85	12.3
IQ (WISC-R)	98.0	13.0	100.1	12.7	95.6	13.2

Table 2

Simple and Partial Correlations of Impulsivity and Efficiency and Academic Performance

		IMPULSIVITY		EFFICIENCY	
		Simple r	Partial r	Simple r	Partial r
Reading	N=35 Young Ss	-.17	.09	.16	.01
	N=31 Old Ss	-.23	-.14	-.08	-.01
	N=66 Tot Ss	-.20*	-.05	.05	.03
Arithmetic	N=35 Young Ss	-.28**	-.06	.27*	.18
	N=31 Old Ss	-.31**	-.23	.03	.13
	N=66 Tot Ss	-.30***	-.16*	.16	.17*
Cognitive Ability	N=35 Young Ss	-.36***	-.17	.20	.04
	N=31 Old Ss	-.25**	-.14	-.11	-.02
	N=66 Tot Ss	-.31***	-.17*	.07	.05

* = $p < .10$

** = $p < .05$

*** = $p < .01$